Analysis of Expected Rating Changes – General Overview
July 2008

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This report summarizes expected rating changes due to the new Supermarket model, to be implemented on July 28, 2008. The supermarket model is the only update that will impact ratings; therefore only buildings with supermarkets will experience changes.

Aggregate Statistics

Aggregate statistics are computed across a sample of buildings pulled by SRA, including all buildings that contain a supermarket space. SRA applies filters to remove buildings that are owned by EPA and its contractors. A total of 5,174 are analyzed[1].

- The average rating change across all 5,174 buildings is - 23 points
  - 80.3% experience a decrease: average - 29
  - 13.9% experience an increase: average + 6
  - 5.8% experience no change
- **Table 1** demonstrates the range of point changes relative to the average. The distribution of changes is fairly broad.
  - Only about 14 percent of buildings are within +/- five points of the average change (that is, change between -18 and -28 points).
  - More than sixty percent of buildings are within one standard deviation.
  - 97% of the population falls within 2 standard deviations of the average.
    - Only 3% of the population decreases by more than 67 points or increases by more than 21 points

Table 1
Changes Relative to Average

Range around average change (-23 points)	Count	Percent
+/-5 points	702	14%
1 Standard Deviation (+/- 22)	3206	62%
2 Standard Deviations (+/- 44)	4994	97%

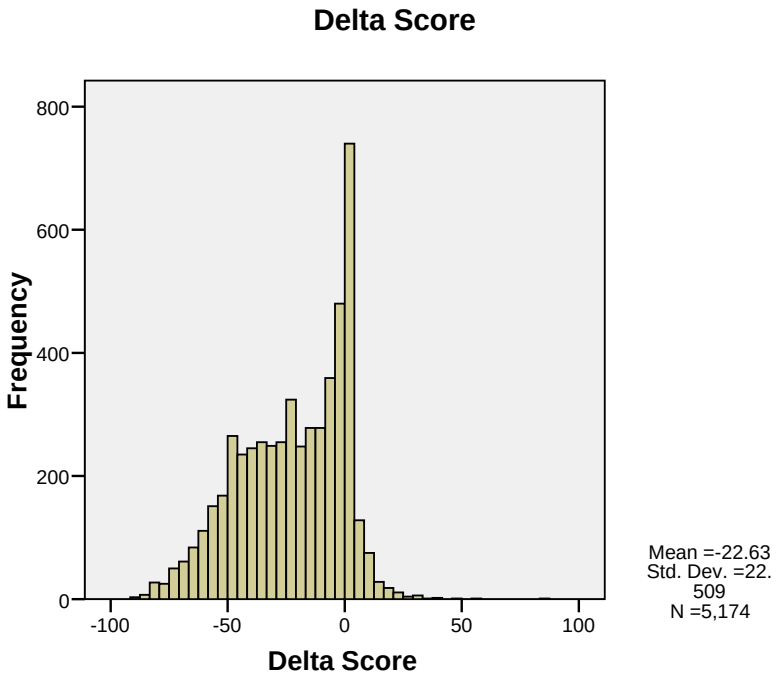
- **Figure 1** presents a histogram, a visual representation of the distribution.
  - Note that the majority of buildings experience a decrease.
  - In bins of 10 points, the mode (largest group) is actually -9 through 0.
    - Over 1,200 buildings (23%) fall between -9 and 0.
  - The distribution is very broad. It is neither unexpected nor atypical that a building may decrease by as many as 40 points.
    - Over 90% of buildings are with in the range of -63 to +17 points.
    - Changes outside of this range are less common, though possible. Individual reviews of these buildings show atypical characteristics:

[1] This figure is after EPA removed 1 additional building. That building has attributes that are not physically possible: 1,000,000 workers, refrigerators, and computers in a 100,000 square foot building.

- Buildings appear to be other space types based on attributes and building owners
- Buildings have very extreme values for one or more operating characteristic (e.g. 4 times the average or 1/4 of the average).

- Specific reports regarding the performance of partners of interest are provided under separate cover.

Figure 1: Histogram of Score Changes



Label Information

- When this data was pulled, 609 of the buildings had earned the label in 2006 or 2007.
  - Only 594 of these ***currently*** have ratings of 75 or higher
    - Of this group 296 will still have ratings over 75 after the changes: These buildings will still be eligible for labels.
    - Of this group, ***298 will have ratings below 75 after the changes: these buildings will no longer be eligible for labels.***
    - Due to the number of buildings "losing" eligibility, specific information on individual buildings and owners is not provided in this memo. It will be provided to the appropriate sector team.
  - 15 of these currently have ratings below 75 and will still have ratings below 75 after the changes
    - These buildings are not currently eligible for labels.
- Currently, 4,281 of the buildings in the analysis have ratings of 75 or higher.

    - In other words, 83% of supermarkets are currently eligible to apply for the label.
    - This illustrates that buildings are currently scoring ***very high***.
- After the changes, 2,222 of the buildings in the analysis will have ratings of 75 or higher.
    - In other words, after the changes 43% of the buildings in the tool will be eligible to apply for the label.
    - Although this population represents a much smaller eligible percent, it is still ***exceptional performance***.

Description of Technical Changes

As noted, the only change on July 28, 2008 which will impact ratings is the introduction of a new model for supermarkets.

General Changes

The new model is based on more recent market data and is characterized by superior statistical properties.

- **Data**: The new model is based on CBECS 1999 and 2003 data, while the old model was based on CBECS 1992 and 1995 data. More recent data provides a more accurate description of the current market conditions.
- **Unit of Analysis**: The new model is based on Source EUI rather than LN(Source Energy). Source EUI is equally robust and easier to explain.
- **New Operating Characteristics**: The new model has added three explanatory variables:
    - Percent that is Heated and Cooled: These variables allow for superior adjustments for climate (CDD and HDD)
    - Number of walk-in refrigeration units: This variable allows for a superior assessment of the level of business activity and required refrigeration.
- **Removed Operating Characteristics**: The new model no longer contains some variables which were found to be insignificant. Analysis of both CBECS and Portfolio Manager data confirms that there is ***not a meaningful, statistically significant relationship*** between these characteristics and energy consumption at supermarkets. Ratings exhibit no bias or skew with respect to these variables.
    - Number of open/closed refrigeration cases
    - Number of computers & Number of cash registers
    - Number of floors
- **Statistical Measures:** Overall, the statistical properties of the new model are superior to the old (higher levels of significance, higher effective R^2 value, etc).

Impacts to Ratings

Overall, the new model will result in lower ratings, with an average change of -23 points. This trend likely reflects the fact that the market has gotten more efficient over the last ten to fifteen years (recall that the current/old model employs 1992 CBECS data).

As noted above, currently 83% of buildings in Portfolio Manager with supermarkets are eligible to apply for the label. This is far above the percent that would be expected in completely random population (25%). Under the new methodology, the percent of potentially eligible will still be very high, 43%. This level is still exceptional, but is more realistic. On balance the new model provides a more uniform distribution.

A simple way to consider the changes is that buildings are awarded an allowance for each operating parameter (square foot, workers, etc) and generally with the new model the size of these allowances has decreased because the market is more efficient. General trends with respect to each characteristic are as follows. These changes were computed in theoretical simulations and verified in the actual data for the 5,174 buildings. Note that at any specific building there will be a unique combination of these characteristics; it can be difficult to forecast an exact change.

- **Worker density** (number of workers per 1,000 square foot). Buildings with greater worker density are more likely to see larger decreases. In effect, because the average building is now more efficient, a building gets a smaller allowance per person.
- **Operating hours**. Buildings with longer hours of operation may see lager decreases in rating. In effect, because the average building is now more efficient, the building gets a smaller allowance per hour. This trend is less pronounced than other trends.
- **Size**. Due to the change from Source Energy to Source EUI, it is very difficult to decouple the impact of size from the impact of other characteristics. The effect of size on its own seems to be relatively small. It seems that very small buildings may be more prone to experience smaller decreases or even increases in rating, while larger buildings may see larger decreases.
- **Cooking** (yes/no). Effectively buildings that do not have cooking are not impacted by a change in the cooking adjustment. Buildings with cooking are now getting a smaller allowance, so they may see larger decreases as compared with buildings that do not have cooking.
- **Cooling Degree Days** (CDD). CDD generally has the opposite trend of typical operational variables: that is, on the whole the new model gives relatively larger allowances for climate conditions. It is not clear why this would be the case, but one hypothesis is that as other aspects of operation have gotten more efficient, the percent of energy used for cooling is larger, so these adjustments are now larger. Buildings with high values of CDD may experience smaller decreases or even increases, while buildings with very low CDD will see larger decreases.
- **Heating Degree Days** (HDD). HDD trends in the same direction as CDD; that is, higher values are likely associated with smaller decreases. On the whole this trend is much smaller, and only seen at very extreme HDD levels. It is hypothesized that heating is a much smaller concern for a supermarket and therefore has a less pronounced effect.
- **Walk-in refrigeration density** (number of walk-in units per 1,000 square foot). Walk-in refrigeration was ***not*** in the old model, so buildings were effectively receiving an average allowance. In effect this gave a bonus to supermarkets with

below average densities of walk-in units, and penalized those with higher densities. Now that this variable is included, buildings are getting the proper adjustments they deserve. Buildings with particularly high densities of walk-in refrigeration are likely to see smaller decreases (or even increases) in their ratings.

- **PC density** (number of computers per 1,000 square foot). The old model adjusted for the number of PCs/Registers. The current analysis of CBECS and Portfolio Manager data indicates that this adjustment is not warranted. As such, buildings that have more PCs/Registers are currently getting an extra allowance. Under the new methodology, they do not get that allowance and therefore experience bigger decreases.
- **Open and closed refrigeration case density** (the number of open and closed cases per 1,000 square foot). Like PCs, this variable is in the old model but not in the new model. This means that they currently get an allowance that is not warranted. With the removal of that allowance, buildings with a greater density of open and closed cases are likely to experience greater decreases. ***Note that there is no bias in the new rating with respect to this variable.*** However the changes in rating may show trends indicating a bias in the old model.

Changes to User Entry Requirements

Due to the addition of some new operating characteristics and the removal of others there are some changes to the user input requirements.

- **New Inputs**: these inputs are now required to receive a rating.
  - Percent Heated and Percent Cooled are the only two ***new*** user inputs. All buildings will be defaulted to values of 100% heated and 100% cooled. In order to qualify for the label, users will need to update this, by selecting the appropriate bin of 10 (0, 10, 20, etc).
- **Unchanged Inputs**: these inputs are already required and will continue to be.
  - Floor area
  - Weekly operating hours
  - Number of workers on main shift
  - Presence of cooking facilities (yes/no)
  - Number of walk-in refrigeration units (currently required though not used in the rating).
- **Optional Inputs**: These variables are no longer required for a rating but will remain in the tool for management purposes. They will become optional.
  - Number of registers/personal computers
  - Number of open and closed refrigeration cases
- **Removed Input:** this variable is not required for benchmarking and is considered of limited value due to mezzanine configurations. Therefore it will be removed.
  - Number of Floors